

## **ACOUSTIC DESCRIPTION OF ACEHNESE MONOPHTHONG VOWELS: FEMALE VS. MALE SPEAKERS FROM EAST ACEH**

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### **ABSTRACT**

This research aims to describe the Acehnesse monophthong vowel qualities produced by the female and male speakers of the North Aceh dialect in Aceh. Previous studies have described the characteristics of these vowels acoustically, nevertheless, these studies only focused on the female speakers. This study intends to fill in the research gap by also investigating the male speakers. Purposive sampling was used to select five female and five male speakers as the participants. Data were collected and analyzed in the Phonetics Laboratory at Syiah Kuala University. The vowels were collected through elicitations of ten Acehnesse target words (adapted from Pillai & Yusuf, 2012) articulated in carrier sentences. The recordings were saved in WAV files, and Praat software version 6.0.14 (Boersma & Weenink, 2016) was used to analyze the qualities of the vowels. The first two formants (F1 and F2) were cues for their acoustic description. Based on the average values of the formants and t-tests, the results showed that each vowel quality between the female and male speakers is significantly different. The vowel space of the female speakers is also seen to be lower and more fronted compared to the vowel space of the male speakers, which is seen to be higher and more back. Hence, this study has revealed the approximate values and measurements of the Acehnesse monophthong vowel qualities produced by female and male speakers as a scientific documentation that can benefit future research in Acehnesse language variation, language change, and dialectology.

**Keywords:** Vowels, monophthongs, Acehnesse, acoustic analysis, Praat.

### **INTRODUCTION**

Acehnesse is a regional language of Indonesia that is spoken in Aceh Province, Indonesia. Aceh is populated by a number of ethnic groups (Wu, 2006), thus there are nine local languages spoken in the province all of which are distinct from each other. They are Acehnesse, Alas, Gayo, Tamiang, Aneuk Jamee, Kluet, Singkil, Simeulu and Haloban (Wildan, 2002). Specifically for Acehnesse, Asyik (1987) has previously provided a classification and explanation related to its dialects. According to Asyik (1987), Acehnesse has four main dialect groups namely the Greater Aceh (spoken in Aceh Besar Regency), the Pidie dialect (spoken in Pidie and Pidie Jaya Regencies), the North Aceh dialect (spoken in several areas such as East Aceh, North Aceh, and Bireuen Regencies), and finally the West Aceh dialect (dominantly used in west coast of Aceh in Aceh Jaya, West Aceh, Nagan Raya, and South Aceh Regencies). According to Asyik (1987), Durie (1985) and Sulaiman, et al. (1977), the North Aceh dialect is considered to be the standard of Acehnesse because of its consistent language structure and large number of speakers. Furthermore, Zulfadli (2014) adds that the Pase or North Aceh dialect is used by around 512.000 speakers in North Aceh and East Aceh.

Asyik (1987) describes the Acehnesse monophthongs to consist of ten oral vowels: front vowels /i/, /e/, /ɛ/, central vowels /u/, /ə/, /ʌ/, /a/, and back vowels /u/, /o/ and /ɔ/. Additionally, Pillai and Yusuf (2012) and Yusuf (2013) complemented these descriptions by measuring these vowels acoustically. Acoustic phonetics is described as an instrumental science that store, reproduce, visualize, and analyze the speech signal (Jongman, 2013). A number of software is now available to do so, and the study by Pillai and Yusuf (2012) and Yusuf (2013) had used the software Praat to analyze their data. Their study only recorded the female speakers of the North Aceh dialect from Lhokseumawe, Aceh. Based on the average measurement of the vowels, the findings of their study showed that the vowel quality of /i/ is F1=428.7 Hz and F2=2653.2 Hz, /e/ is F1=503.6 and F2=2517.8, /ɛ/ is F1=629.1 Hz and F2=2386.1 Hz, /u/ is F1=470.2 Hz and F2=1623.8 Hz, /ə/ is F1=546.9 Hz and F2=1824.8 Hz, /ʌ/ is F1=643.1 and F2=1895.0 Hz, /a/ is F1=877 Hz and

F2=1831.4, /u/ is F1=462.8 Hz and F2=1367.3 Hz, /o/ is F1=531.2 Hz and F2=1013.3 Hz and /ɔ/ is F1=668.8 Hz and F2=1412.1 Hz.

However, there have been a number of studies on the vowels of the Acehese monophthongs (in varying degrees of detail). These include those conducted by Sulaiman, et al. (1977), Durie (1985) and Asyik (1972, 1987) who analyzed the vowels by auditory approach and others who analyzed the vowels by acoustic approach (see Pillai & Yusuf (2012), Yusuf (2013), and Yusuf & Pillai (2016)). On the other hand, these latest acoustic studies collected data only from female speakers of the North Aceh dialect. Henceforth, this research intends to fill in the research gap by investigating both the female and male speakers' vowel production of the North Aceh dialect.

The results of this research are expected to contribute to the existing knowledge and scientific documentation of the Acehese monophthong vowels. The results also specifically describe the characteristics in terms of its physical properties of each Acehese oral monophthong produced by both male and female speakers. Furthermore, this research can benefit future research as well in Acehese language variation, language change, and dialectology.

## METHOD

The data were obtained from recordings of five native Acehese male speakers and five Acehese female speakers who live in East Aceh of the North Aceh dialect. The recording and analysis were done in the Phonetics Laboratory at the English Education Department, Faculty of Teacher Training and Education, Syiah Kuala University, Banda Aceh. The average age of these speakers ranged from 40-60 years old. These speakers were chosen based on certain criteria in order to attain trustworthy and dependable data, which are: native speakers of North Aceh dialect, have not lived outside of their residence throughout their life except for short holidays to other places, have no dental problems, have no lips deformation (i.e. harelip or orofacial cleft), and have no hearing problems.

The data were collected from elicited speech of a words list. The word list from Pillai and Yusuf (2012) were adapted because this study was a similar initial study on Acehese vowels by using acoustic analysis. These target words preceded and followed by stops or fricatives in a CVC or CV environment. Moreover, these target words were embedded in the carrier sentence of "*Ucap \_\_\_ sigoe teuk*" [Say \_\_\_(the target word)\_\_\_ once again]. Identical or similar environments for the vowels in the target words embedded in the carrier sentence were to lessen the influencing sounds from its surroundings (King, 2006). For each vowel, the speakers were asked to insert the target word in the blank space and to produce the simple sentence six times.

## ANALYSIS

For the measurements of ten Acehese oral monophthongs from both female and male Acehese speakers, a total of 600 elicitation tokens were selected. Every speaker repeated ten of the target words six times each, and this resulted in 30 tokens for every vowel from every speaker.

Praat software version 6.0.14 (Boersma & Weenink, 2016) was used to analyze the qualities of the vowels. After elicitation, the recorded data was saved in WAV file, and were measured in Hertz by using Praat software. The first and second formants (F1 and F2) shown in the spectrogram were used to measure the midpoint of a monophthong from the target word (Ladefoged, 2003) produced by the speaker. Then, the data were transferred to Microsoft Excel and the number in Hertz were converted to Bark scale (Deterding, 2003) by using the following formula  $Bark = 13 \arctan(0.00076 f) + 3.5 \arctan((f/7500)^2)$  (Traunmüller, 1990). By using Excel, the researcher created the vowel chart that has already been designed by Deterding (2003).

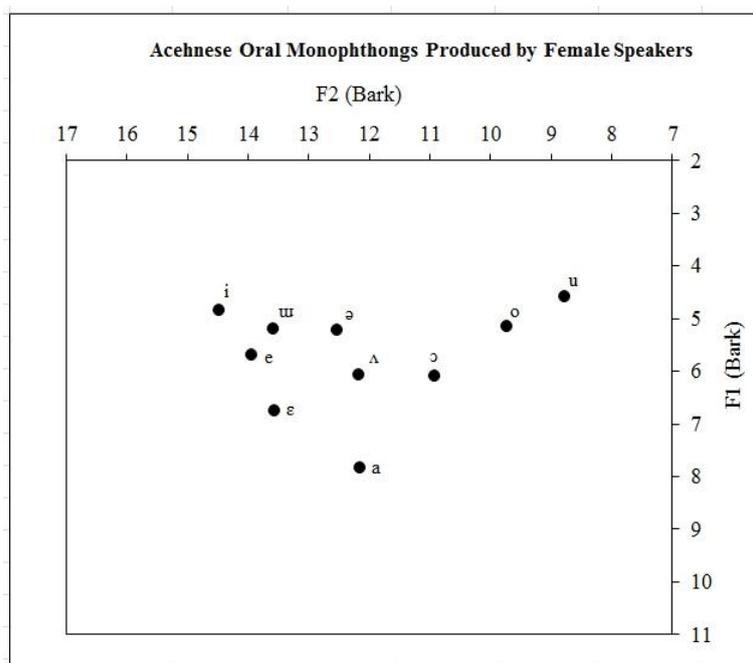
## FINDINGS

The average duration and formant frequencies for F1 and F2 of each vowel produced by Acehese female speakers in East Aceh are shown in Table 1.

**Table 1.** F1 and F2 average values for Acehnese oral monophthongs produced by female speakers.

Vowel	Target Word	Duration (sec)	Ave. F1 (Hz)	Ave. F2 (Hz)	Ave. F1 (Bark)	Ave. F2 (Bark)
i	<i>tip</i>	0.107	511	2491	4.83	14.49
u	<i>teuk</i>	0.112	553	2158	5.19	13.59
u	<i>kuk</i>	0.122	482	1042	4.58	8.77
e	<i>pét</i>	0.123	614	2282	5.70	13.94
ə	<i>tet</i>	0.106	557	1832	5.23	12.53
o	<i>pôt</i>	0.098	546	1206	5.14	9.73
ɛ	<i>bèk</i>	0.100	746	2152	6.74	13.57
ʌ	<i>göt</i>	0.103	659	1735	6.06	12.17
ɔ	<i>top</i>	0.096	664	1442	6.10	10.93
a	<i>pat</i>	0.095	898	1733	7.83	12.16

The placement of vowels in the vowel space for the Acehnese female speakers can be seen in Figure 1.



**Figure 1.** Scatter plot of formant average values for Acehnese oral monophthongs produced by female speakers in the vowel space.

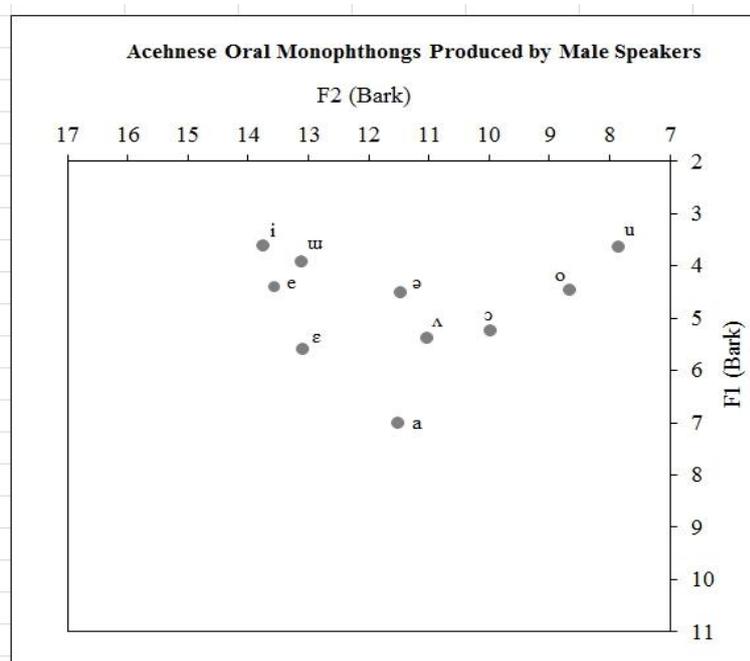
Based on Figure 1, the positions of [i], [e], and [ɛ] are similar to the descriptions of these vowels in the previous acoustic studies of Acehnese study by Pillai & Yusuf (2012) and Yusuf (2013) who also used female speakers in their research. However, in this research, [u] is located more fronted and seems closer to [i], [e], and [ɛ]. Moreover, the placement of [u] is also located more back and higher than that described by those previous studies.

Moreover, the average duration and formant frequencies for F1 and F2 of each vowel produced by Acehnese male speakers in East Aceh are shown in Table 2.

**Table 2.** F1 and F2 average values for acehnese oral monophthongs produced by male speakers.

Vowel	Target Word	Duration (sec)	Ave. F1 (Hz)	Ave. F2 (Hz)	Ave. F1 (Bark)	Ave. F2 (Bark)
i	<i>tip</i>	0.080	373	2212	3.60	13.75
u	<i>teuk</i>	0.107	407	2002	3.91	13.11
u	<i>kuk</i>	0.109	376	901	3.63	7.85
e	<i>pét</i>	0.090	464	2141	4.42	13.54
ə	<i>tet</i>	0.088	474	1560	4.51	11.46
o	<i>pôt</i>	0.096	468	1023	4.45	8.66
ɛ	<i>bèk</i>	0.097	600	1994	5.58	13.08
ʌ	<i>göt</i>	0.101	574	1463	5.37	11.03
ɔ	<i>top</i>	0.092	560	1249	5.25	9.97
a	<i>pat</i>	0,082	762	1570	6,86	11,50

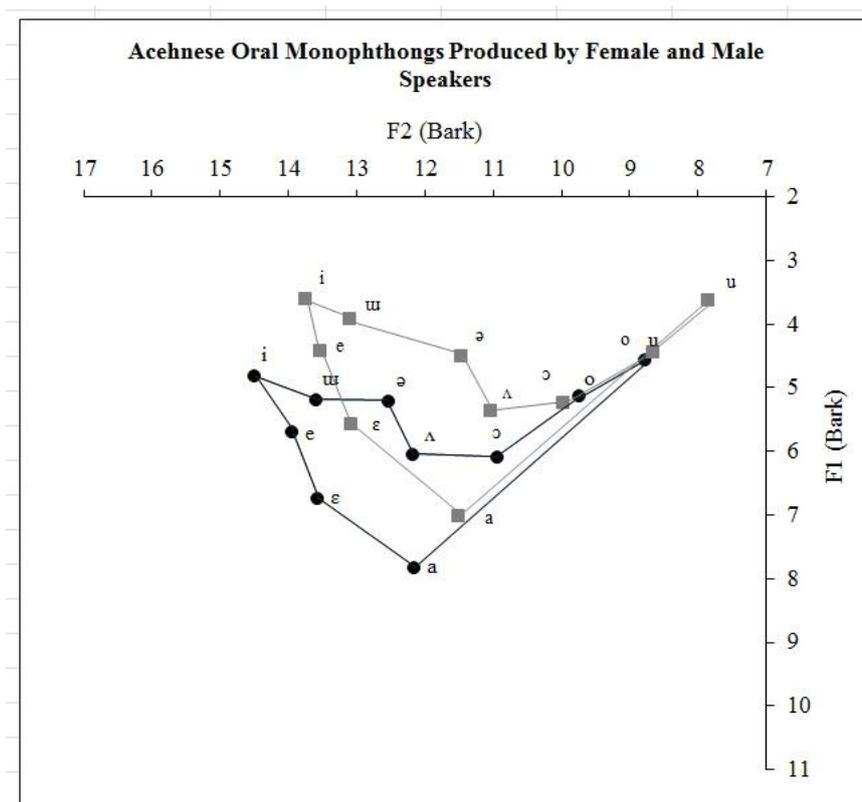
The placement of vowels in the vowel space for Acehnese male speakers can be seen in Figure 2.



**Figure 2.** Scatter plot of formant average values for Acehnese oral monophthongs produced by male speakers.

The position of [u] that has been described as a mid-vowel in the previous studies (Asyik, 1987; Durie, 1985) is seen to be more fronted in Figure 2. However, [ə], [ʌ], and [a] are seen to be as mid-vowels and this is similar to what Asyik (1987) and Durie (1985) has previously described. The vowels [ɔ], [o], and [u] are back vowels with [u] seen to be positioned as the farthest back vowel.

In addition, Figure 3 illustrates the scatter plot of formant average values for Acehnese oral monophthongs produced by both female and male speakers in the vowel space. The theory claims that there are differences in F1 and F2 production in vowels between female and male speakers (Kent & Read, 1999). The findings in this research are also relevant with a number of research done by several researchers (Jacobi, 2009; Mokhtar & Hamid, 2012; Yusuf, 2013) that have found the vocal tract differences between female and male speakers do give impact to their vowel qualities.



**Figure 3.** Acehnese oral monophthongs vowel space of female and male speakers (females are black dots and graph, meanwhile males are dark gray)

The vowel space of the female and male speakers of the North Aceh dialect has proven that female and male speakers produce sounds, especially vowels, differently. The Acehnese female vowel space is seen lower and more fronted compared to the male vowel space that is higher and more back.

### CONCLUSION

This study has described the characteristics in terms of its physical properties of each Acehnese oral monophthong produced by both male and female speakers. It further illustrates the differences of vowel qualities between the male and female speakers based on the scatter plot of the vowels in the vowel space. The female vowel space is lower and more fronted compared to the male vowel space that is higher and more back. Nevertheless, the findings of this preliminary study did not use t-tests to further confirm the differences of production between the male and female speakers. Therefore, another study that can complement this current one is needed to substantially explain the differences of vowel productions by using statistics.

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